

## Southern bacterial wilt, caused by *Ralstonia solanacearum*

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Southern bacterial wilt has re-emerged as a disease of concern, especially to geranium growers (Williamson et al, 2001, 2002; Kim et al, 2002). This disease has been described in the past (Hayward, 1991; Hayward and Hartman, 1995; Strider et al, 1981; Strider, 1982), but it has recently taken on renewed importance for ornamentals producers. It is caused by a bacterium, *Ralstonia solanacearum*, that was previously known as *Pseudomonas solanacearum*. This is one of two bacterially-caused vascular wilt diseases of geranium: growers are much more familiar with bacterial blight caused by *Xanthomonas campestris* pv. *pelargonii* (Xcp). *Ralstonia solanacearum* is less host-specialized than *X. pelargonii*, which is only able to affect plants in the Geraniaceae (including *Pelargoniums* and hardy geraniums).

Different races of *R. solanacearum* have different host ranges, including one called Race 1 that can affect many flowering crops (see Table)(Harris, 1972; Denny and Hayward, 2001). A number of weeds are known to serve as symptomless carriers of *R. solanacearum*. *Ralstonia solanacearum* is also typed according to variations in metabolic activity into 5 or 6 different biovars. Earlier descriptions of *R. solanacearum* on geraniums (Strider 1981, 1982) probably referred to disease caused by Race 1, which is endemic in the southern US.

**Table 1. Races and Biovars of *Ralstonia solanacearum***

Race	Host Range	Geog. Distribution	Biovar
1	Wide	Asia, Australia, Americas	3, 4 1
2	Banana Other Musa spp.	Caribbean, Brazil Phillipines	1
3	Potato, some other Solanaceae, Geranium; plus a few other species.	Worldwide except US and Canada	2
4	Ginger	Asia	3, 4
5	Mulberry	China	5

(Reprinted, with slight modification, from Denny and Hayward, 2001)

Currently, the most important race/biovar of *R. solanacearum* is Race 3, Biovar 2, which has valuable agricultural hosts as well as a few known ornamental hosts. It is of special concern to the potato industry in the United States and Canada, because Race 3 is a cold-temperature tolerant strain that has caused serious disease problems in potato crops in other temperate countries around the world. Bacteria identified as Race 3, Biovar 2 of *R. solanacearum* were imported into the US from Guatemala in geranium cuttings on several occasions in 1999 (Williamson et al 2002, Kim, 2002). Geranium industry leaders

have since come together to discuss their clean stock systems and work with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) and the Society of American Florists (SAF) to develop procedures that tightly guard against the introduction of any race of *R. solanacearum* via geraniums. Efforts made to improve the cleanliness of offshore geranium material were successful in 2002: There were no reported cases of *R. solanacearum* Race 3, Biovar 2 in the US—and bacterial blight caused by *Xanthomonas pelargonii* was also very rare. According to the company who owns the Kenyan facility, the current 2003 outbreak of *Ralstonia* derived from a breach of sanitation in Kenya that led to the contamination of 7 stock plants. State and APHIS personnel are now working to track down and eradicate any geraniums with the disease that reached US growers.

*Ralstonia solanacearum* Race 1 is endemic in the United States, so growers may encounter this pathogen occasionally, particularly in the Southern US. This race is known to infect hundreds of different plant species in 50 families. Some of the flower crops known to be susceptible to Race 1 are browallia, ornamental peppers, catharanthus, cyclamen, dahlia, fuchsia, gerbera, hydrangea, impatiens, lantana, pelargonium, cineraria and schizanthus.

Because *R. solanacearum* causes a systemic vascular wilt and does not cause leaf spot symptoms, it does not appear to be very contagious within a greenhouse on overhead-irrigated crops. The route of infection is usually through the roots. In the operations that encountered *R. solanacearum* on their geraniums in 1999, none of the growers reported spread to any of their other flower crops, and symptoms did not appear to spread within the crop. The picture is quite different for subirrigated crops: *Ralstonia* spreads very easily via water used for subirrigation, just as it will spread rapidly by water in field situations. Irrigating geranium stock plants on trickle-tubes is an important safeguard against spread of either of the systemic bacterial diseases. Geranium stock should never be subirrigated.

The symptoms of a geranium with Southern wilt are sometimes very hard to distinguish from those of bacterial blight caused by *Xcp*. Both diseases cause a wilt of the systemically infected plants. *Xcp* can also cause leaf spots, but *Ralstonia* cannot. Plants infected by *R. solanacearum* will show yellowing, wilting and browning of lower leaves. If petioles of infected, symptomatic leaves are chopped up and set into water in a test tube, the water will often turn very cloudy as the bacteria stream out of the xylem. Vascular discoloration in the stem is common, and roots may sometimes turn brown. With *Xcp*, vascular discoloration is less pronounced or absent, and roots remain white. The bacteria may be cultured from diseased stem or petiole tissue in a diagnostic laboratory by streaking from the bacterial that flow out from diseased tissue into sterile water. Quick serological tests are now available for detection of the genus and species of *Ralstonia solanacearum*. Once samples have already been identified to the species level, identification of Race 3, Biovar 2 must be handled only by an officially permitted lab. For USDA, samples are being handled by the USDA, APHIS, PPQ-CPHST lab of Dr. Laurene Levy. This lab should receive only appropriately labeled samples that have been screened for the genus and species. See the USDA action plan for more guidance on sample handling, available at: <http://www.aphis.usda.gov/ppq/ep/ralstonia/>.

This disease is important to the flower industry because of its threat to geraniums and other ornamentals and also because of its potential threat to food crops. Fortunately, safeguards are already in place to protect geraniums against both diseases: clean stock production systems and sanitation efforts are effective against both *Xanthomonas* and *Ralstonia* simultaneously. When coupled with responsible growing practices at every greenhouse, the efforts that geranium propagators make to ensure that geraniums are

disease-free will keep growers safe from massive bacterial disease outbreaks. The current eradication effort will prevent *Ralstonia solanacearum* Race 3 Biovar 2 from becoming established in this country.

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